>> Label-free Functional Analysis for the Screening of iPSC-derived Neural Organoid Response to Neuroactive Compounds

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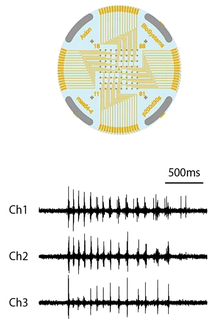
Live-Cell Analysis

Microelectrode Array Technology

Axion BioSystems' Maestro™ multiwell microelectrode array (MEA) platform offers such a solution by providing a label-free, non-invasive bench-top system to simply, rapidly, and accurately record functional activity from a population of cells cultured on an array of extracellular electrodes in each well.



The Maestro MEA Product Family

Features	*Maestro Pro*	*Maestro Edge*	*Maestro Volt**
Throughput (well format)	6, 24, 48, 96, 384**	6, 24, 96**	6
MEA Mode	✓	✓	✓
MEA Viability	✓	✓	
Impedance Mode	✓	✓	
Environmental Control	✓	✓	✓
Automation API	✓	✓	
Stimulation	Electrical & Optical	Electrical & Optical	Electrical
Omni Compatible	✓	✓	✓

*Maestro Volt only available in Europe and Asia
**Well format available in impedance only

The Omni Product Family

Features	*Lux3*	*Omni Pro 12*	*Omni*
Whole-well/Plate Brightfield		✓	✓
Automated Acquisition	✓	✓	✓
Fluorescence	✓	✓	✓
Plate Handling	Manual	Automated	Manual
Number of Plates	1	12	1
Incubator Compatible	✓	✓	✓
Dimensions & Weight	166 x 140 x 135 mm 1,3 kg	460 x 417 x 439 mm 40,2 kg	345 x 396 x 171 mm 9,7 kg

Real-time Monitoring of Organoids

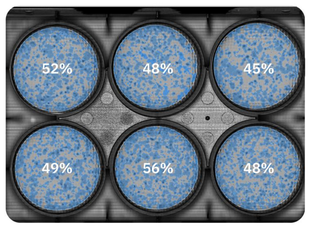
Background

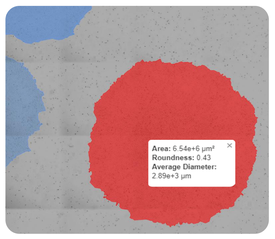
Recent advances in induced pluripotent stem cell (iPSC) technology have revolutionized *in vitro* models of neural physiology. Perhaps the most exciting examples of this progress are neural organoids, three-dimensional cellular models made of multiple cell populations differentiated from iPSCs that better recapitulate *in vivo* cellular diversity and spatial architecture. Here, we describe a workflow for monitoring neural organoid formation and subsequent electrophysiological characterization of organoid response to neuroactive compounds.

iPSC Module tracks iPSC growth

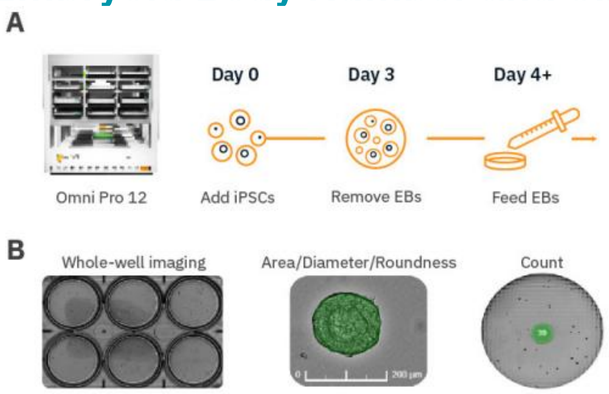
The Omni is a live-cell analysis platform is capable of continuous multi-well imaging directly from the incubator.

Example whole-well brightfield images of iPSC colonies acquired by the Omni in a 6-well plate with the confluency map overlay and a close up of a single colony with the metrics provided by the iPSC Module including area, diameter, and roundness.





Organoid Analysis Monitors Embryoid Body Number and Size

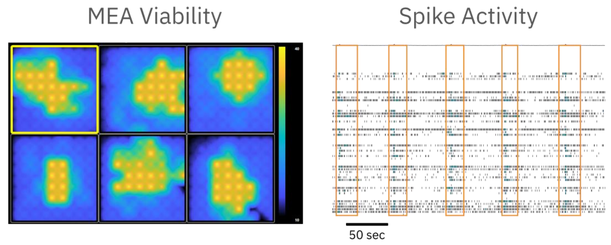


EBs were formed via forced centrifugation in Aggrewell™ 800 plates and monitored over several days via the Omni platform. Example whole-well brightfield images of EBs and the metrics provided by the Organoid module are shown.

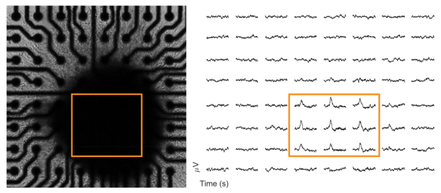
MEA Assay with Neural Organoids

Real-time Functional Analysis of iPSC-Neural Organoids

The Maestro MEA platform can be used to characterize the activity of iPSC-derived neural organoids in real-time by measuring important neural metrics such as viability, neural spike activity, and local field potentials (LFP).

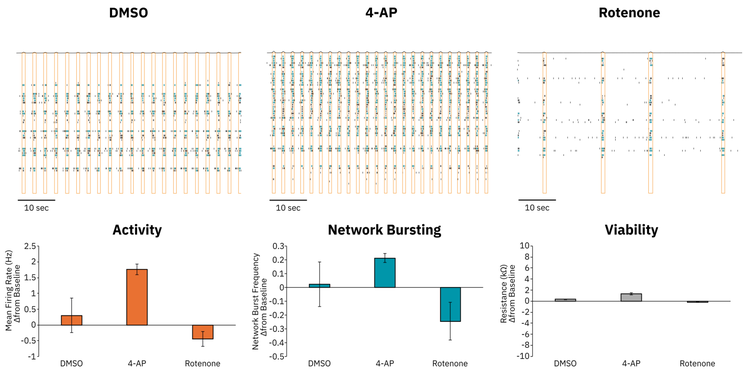


Local Field Potentials (LFPs)



Midbrain Organoid Response to Neuroactive Compounds

We dosed pre-made midbrain organoids (STEMCELL Technologies, Cat. # 200-0793) at 125 days post differentiation with 4-AP and rotenone and monitored their response on the Maestro Pro. 4-AP increased mean firing rate and network burst frequency, while rotenone led to marked decreases in both metrics.



Conclusion

These results demonstrate the complimentary abilities of the Omni and Maestro systems for monitoring iPSC-derived neural organoid differentiation and electrophysiological assessment, including for the screening of neuroactive compounds.